U.S. Fish & Wildlife Service

ENDANGERED Species BULLETIN

January/February 1999 Vol. XXIV No. 1

Images of some of our Nation's environmental disasters are all too easy to recall: blackened beaches, oil soaked birds and marine mammals struggling for life, and chemically-poisoned fish littering the shoreline. Equally serious, but not as dramatic, is the more subtle damage to wildlife populations from other sources, such as pollutants that interfere with reproduction or disrupt complex ecological relationships. Preventing these problems, measuring the effects when they do occur, and directing restoration activities comprise a huge undertaking. Within the Fish and Wildlife Service, the responsibility rests with the Environmental Contaminants Program. In this edition of the Bulletin, *we take a look at some of the efforts to ensure a safe environment for wildlife and people alike.*

U.S. Fish & Wildlife Service

WASHINGTON D.C. OFFICE *Washington, D.C. 20240*

Jamie Rappaport Clark, *Director*
Gerry Jackson, *Assistant Director for Ecological Services*

E. LaVerne Smith, *Chief, Division of Endangered Species*	*(703)358-2171*
Richard Hannan, *Deputy Chief, Division of Endangered Species*	*(703)358-2171*
Kathi Bangert, *Chief, Branch of Information Management*	*(703)358-2390*
Susan Linner, *Chief, Branch of Conservation & Classification*	*(703)358-2105*
Charlie Scott, *Chief, Branch of Recovery & Delisting*	*(703)358-2106*
Rick Savers, *Chief, Branch of Consultation & HCPs*	*(703)358-2106*

REGION ONE *Eastside Federal Complex, 911 N.E. 11th Ave. Portland OR 97232*

California, Hawaii, Idaho, Nevada, Oregon, Washington, American Samoa, Commonwealth of the Northern Mariana Islands, Guam and the Pacific Trust Territories

Anne Badgley, *Regional Director* — *(503)231-6118*
http://www.r1.fws.gov

REGION TWO *P.O. Box 1306, Albuquerque, NM 87103*

Arizona, New Mexico, Oklahoma, and Texas

Nancy Kaufman, *Regional Director* — *(505)248-6282*
http://ifw2irm2.irm1.r2.fws.gov/

REGION THREE *Federal Bldg., Ft. Snelling, Twin Cities MN 55111*

Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin

William Hartwig, *Regional Director* — *(612)715-5301*
http://www.fws.gov/r3pao/

REGION FOUR *1875 Century Blvd., Suite 200, Atlanta, GA 30345*

Alabama, Arkansas, Louisiana, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Florida, Tennessee, Puerto Rico, and the U.S. Virgin Islands

Sam Hamilton, *Regional Director* — *(404)679-7086*
http://www.fws.gov/r4eao

REGION FIVE *300 Westgate Center Drive, Hadley, MA 01035*

Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia

Ronald E. Lambertson, *Regional Director* — *(413)253-8300*
http://www.fws.gov/r5fws

REGION SIX *P.O. Box 25486, Denver Federal Center, Denver CO 80225*

Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming

Ralph O. Morgenweck, *Regional Director* — *(303)236-7920*
http://www.r6.fws.gov

REGION SEVEN *1011 E. Tudor Rd., Anchorage, AK 99503*

Alaska

Dave Allen, *Regional Director* — *(907)786-3542*
http://www.r7.fws.gov/

ENDANGERED Species BULLETIN

Telephone: (703)358-2390
Fax: (703)358-1735
Internet:
R9FWE_DES.ESB@fws.gov
http://www.fws.gov/r9endspp/endspp.html

Editor
Michael Bender

Associate Editors
Martha Balis-Larsen
Kelly Geer

Art Director
David Yeargin

Contributors
Mary G. Henry
Greg Balogh
Jim Dwyer
Pedro Ramirez, Jr.
Cindy Chafee
Kevin Stubbs
John T. McCloskey
Elaine Snyder-Conn
Mike Green
Tom O'Brien
Scott Stenquist
Richard G. Biggins
Ben Ikenson
Martha Balis-Larsen
Kelly Geer
Tom Augspurger
John Fridell
Dan Sparks
Scott Sobiech
Karen Cathey
Sam Johnson
Don Steffeck
Robert S. Butler
Nora A. Murdock
Gerry Jackson

On the Cover
Monitoring water quality helps biologists detect contaminants in aquatic habitats that may not be obvious to casual observers.
Photo by Keith Weller/USFWS

Opposite page
The bald eagle, once decimated by the pesticide DDT, has rebounded thanks to the ban on this chemical and by Endangered Species Act protection of nesting habitats.
Corel Corp. photo

The Endangered Species Bulletin welcomes manuscripts on a wide range of topics related to endangered species. We are particularly interested in news about recovery, habitat conservation plans, and cooperative ventures. Please contact the Editor before preparing a manuscript. We cannot guarantee publication.

The Fish and Wildlife Service distributes the Bulletin primarily to Federal and State agencies, and official contacts of the Endangered Species Program. It also is reprinted by the University of Michigan as part of its own publication, the Endangered Species UPDATE. To subscribe, write the Endangered Species UPDATE, School of Natural Resources, University of Michigan, Ann Arbor, MI 48109-1115; or call (734) 763-3243.

Printed with vegetable-based ink on recycled and recyclable paper. If you do not keep back issues, please recycle the paper, pass them along to an interested person, or donate them to a local school or library.

IN THIS ISSUE

Maintaining a Healthy Environment

by Mary G. Henry
and Kelly Geer

The question is sometimes asked, "Why does the U.S. Fish and Wildlife Service have an Environmental Contaminants Program? I thought EPA did that stuff?"

Photo by Steve Hillebrand/USFWS

Contaminants enter the environment in many different ways; disposal of municipal wastes, factory discharges, and oil or chemical spills are a few examples. These examples are considered forms of "point-source" (or "end of the pipe") pollution because their origin is easily recognized. The amount of point-source pollution that enters our environment is impressive. For example, in 1995, a reported 2.2 billion pounds of toxic chemicals were released into our land, air, and water[1] and during 1996, 27,347 chemical and oil spills were reported[2]. In addition, there are currently 33,000 known hazardous waste sites.

In many cases the origin of pollution may not be as clear. For example, agricultural pesticides can be carried by runoff, or enter an aquifer, and end up contaminating a stream dozens of miles away. Pollutants can also be carried for long distances through the air and deposited on land and water by rain. Such examples are called "non-point source" pollution. Pollution from non-point sources can contaminate areas that may appear to be relatively untouched. For example, 41 of our nation's Fish and Wildlife Service management units (national wildlife refuges, waterfowl production areas, etc.) have advisories against

Maintaining a healthy environment is an immense responsibility. As the world's human population grows and contaminants accumulate in the environment, the responsibility looms even larger. In fact, it often takes both the EPA and the Fish and Wildlife Service (FWS) to detect the problems and begin to solve them. Although its work benefits the environment as a whole, including natural resources, the EPA has historically emphasized human health and safety issues. On the other hand, the FWS Environmental Contaminants Program focuses on identifying and preventing harmful contaminant effects on fish, wildlife, and plants, and on restoring habitats degraded by various toxic substances.

FWS Environmental contaminants biologists are experts when oil and chemical spills occur. They understand pesticides, water quality alterations, hazardous material disposal, and many other aspects of pollution biology. With their understanding of chemistry and changes in water quality and their knowledge of fish, wildlife, and plants, our scientists know what to look for and where to look in cases of contamination. They do not work solely behind desks; they walk the streams, travel the

backwoods, and note the changes around them. This "on-the-ground" presence enables experienced biologists to understand the connections among pollution, human activities, and changes in wildlife health.

The Fish and Wildlife Service's Environmental Contaminants Program is comprised of four major components:

1) Contaminants Prevention. Contaminants specialists review environmental documents, legislation, regulations, and permits and licenses with pollution potential to ensure that harmful effects on fish, wildlife, and plants are avoided or minimized. Some examples include:

- analysis of documents and permits related to control of nonpoint source pollution from agriculture and urban runoff, point source pollution from industrial and municipal waste treatment facilities, and discharges of dredge and fill material;
- review of proposed Federal projects related to mining, agricultural irrigation, range management, and oil and gas development to ensure that habitat quality concerns are adequately addressed; and
- review of pesticide use on FWS lands to ensure these chemicals are properly applied and, in some cases, to recommend acceptable alternatives.

2) Contaminants Identification and Assessment. Contaminants specialists conduct field studies to determine sources of pollution, to investigate pollution effects on fish and wildlife and their habitat, and to investigate fish and wildlife die-offs. Sites typically assessed include those impacted by drain water from agricultural irrigation and mining, superfund sites, and oil and hazardous waste spills. Field specialists also survey for contaminants prior to FWS acquisition of lands.

3) Contaminant Cleanup and Resource Restoration. Data collected in contaminant assessments is often used to secure compensation for resources lost or degraded by hazardous waste releases or spills. FWS contaminants specialists often take part in the efforts to cleanup contaminated areas, rehabilitate wildlife, and restore habitat. When the U.S. Environmental Protection Agency (EPA), U.S. Coast Guard, Department of Defense, or various other Federal or State agencies are responsible for cleaning up a contaminated area, FWS contaminant specialist are often called in to ensure that fish and wildlife resources and habitats are adequately protected during, and upon completion of, the cleanup. Contaminants specialists also work closely with National Wildlife Refuge managers to design and implement actions to cleanup oil and hazardous material on refuge lands.

4) Technical Support. Training field office staff, analyzing contaminant samples, and managing information are all key to the Contaminants Program's success. A large part of the Program's technical support comes from the Patuxent Analytical Control Facility (PACF) in Laurel, Maryland. Staff at PACF are responsible for such things as overseeing all FWS laboratory analysis and managing the Environmental Contaminants Data Management System. This system is designed to electronically store, analyze, and create reports on the vast amount of analytical information obtained from fish and wildlife tissue samples collected by FWS biologists. Another significant aspect to the Program's technical support capabilities is demonstrated by the Contaminant Information Management and Analysis System (CIMAS). CIMAS provides the ability to view, analyze, and summarize contaminants data from the FWS and other Federal and State agencies and integrate it graphically through the Internet.

Mary Henry is Chief, Branch of Ecosystem Health, in the FWS Division of Environmental Contaminants and Kelly Geer is an Outreach Specialist with the Division of Endangered Species, both in Arlington, Virginia.

consumption of their fish, shellfish, or other wildlife, and most of our national wildlife refuges have either known or suspected contaminant problems.

We are still learning what happens to contaminants once they enter the environment and the effects they have not only on fish, wildlife, and their habitat, but also on human health. Effects on fish and wildlife that have been noted with some chemicals currently registered for use in the United States include: acute toxicity; reproductive, developmental, and behavioral problems; immune system dysfunction; and premature death. It is often years, if not decades, before we may be able to prove that a specific chemical is having a harmful effect on our natural resources and, even if its use is banned, it may continue to persist in the environment for a long time.

[1] 1995 Toxics Release Inventory Public Data Release Overview. Toxics Release Inventory: Community Right-to-Know. (Computer Search: http://www.epa.gov/opptintr/tri/pdr95/drover01.htm#CH2).

[2] NRC (March 1999) National Response Center: Incident Summaries: Incidents Per Year. USDOT/USCG. Washington, D.C. (Computer search: http://www.dot.gov/dotinfo/uscg/hq/nrc/incident.htm)

Lead and the Spectacled Eider

by Greg Balogh

The large white eye patch and black "spectacle," markings that are most apparent in males, inspire the name for this marine duck.
Photo by Margaret Pearson

"Ursus, Come!" No response. Biologist Paul Flint was searching for duck nests on the Yukon-Kuskokwim delta. Again he called to his companion, more urgently this time. "Ursus, get over here!" Like Flint, Ursus, was a veteran nest searcher on Alaska's Yukon-Kuskokwim Delta (Y-K Delta). Unlike Flint, he was a Labrador retriever. And although he had not found a nest for a while, Ursus had just found something far more interesting and horrifying tucked under the overhang of a tidal slough cut bank.

Necropsy results confirmed Flint's suspicions. The spectacled eider that Ursus found had died of lead poisoning, the first such death confirmed. Alarm bells went off in wildlife managers' heads throughout the State. Were these isolated incidents? Where had these threatened birds picked up lead? Could lead poisoning be one of the causes of the astounding 95 percent decline in Y-K Delta spectacled eider numbers since the 1970's? And finally, if this *is* a problem, what can be done about it?

Authorities generally agree that lead poisoning is not the sole cause of the population's rapid decline, but it is likely a contributing factor. Perhaps more importantly, it seems to be a notable obstacle to the species' recovery on the Y-K Delta. The discovery of lead poisoning in spectacled eiders caught resource managers off guard. Why, you may ask, should lead poisoning in ducks surprise anyone? It's been happening to ducks throughout the world for decades. To fully appreciate how unexpected this find was, you have to know a little bit about the eider and where it lives.

To begin, the vast majority of spectacled eiders spend at least 40 weeks a year riding the waves and ice floes of the Beaufort, Chukchi, and Bering seas. Not a lot of lead pellets out there. When they're not far out to sea, the species breeds on arctic and subarctic tundra in northern and western Alaska—land that appears to be largely untouched. The condition of spectacled eider habitat in Siberia is less certain, but it is apparently good enough to host over 90 percent of the remaining world population. So where is the lead coming from?

Each spring, the Yup'ik Eskimos look forward to the arrival of hundreds of thousands of geese. The birds were traditionally a welcome source of fresh meat to natives that had subsisted on dried fish and seal oil for several months. As the regional Yup'ik culture became more and more affected by European and Russian culture, spring hunting took on added importance as a form of "cultural glue" to help hold rural native communities together. For this reason, the Federal and State governments did not actively enforce Migratory Bird Treaty Act prohibitions on spring waterfowl hunting by the Eskimos. (The act is now being revised to make spring waterfowl hunting legal for natives.)

Most Y-K Delta villagers exist well below the poverty level. Therefore, they have continued to use cheaper lead shot despite a 1991 nationwide ban on the use of lead shot for waterfowl hunting. The result of this prolonged use of lead shot has been the deposition of thousands of tons of spent lead pellets in eider habitat. Most of the pellets have been deposited near the

most heavily used (by eiders) coastal wetlands. These areas are frozen most of the year, so lead pellets deposited in these areas are likely to persist in the substrate for a long time. Geese and ducks ingest the pellets while feeding, and the lead enters their bloodstream during digestion.

Scientists with the U.S. Geological Survey's Biological Resource Division and the U.S. Fish and Wildlife Service have spent considerable effort studying the lead poisoning problem on the Y-K Delta. Tests run on spectacled eider blood samples indicate that 13 percent of females pick up lead during the 2-3 week interval between their arrival on the nesting grounds and the initiation of incubation. By the time their eggs begin to hatch, one in four spectacled eider hens have eaten lead. By mid-brood-rearing, an astounding 36 percent of hens have elevated lead levels in their blood. This creates an evolutionary conundrum for the birds. The longer they remain on land trying to breed and pass on their genes, the more likely they are to die of lead poisoning. Even the eider ducklings are subject to this toxic gauntlet. Nine of 43 spectacled eider broods studied contained one or more ducklings exposed to lead by 30 days after hatching. This observed number is likely low because it would not include any ducklings that died before the sample was taken.

So, what is being done about it? The first step in reducing the eiders exposure to lead was to halt the use of lead ammunition by hunters. Dozens of village meetings were held to explain to hunters that their choice of lead shot was hurting the animals. Once informed, most communities were anxious to be part of the solution.

The next step was to find a way to make the non-toxic alternative, steel shot, cheaper. To do this, the Fish and Wildlife Service began working with ammunition manufacturers on ways to get steel shot out to the villages at prices comparable to that of lead. This cooperative effort helped shrink the price discrepancy from several dollars a box in the early 1990's to about one dollar today.

A male spectacled eider in Savoonga, Alaska
Photo by Greg Balogh/USFWS

Finally, to address the problem of what native hunters were to do with the lead shot that they already had in their possession, the Fish and Wildlife Service teamed up with Ducks Unlimited to provide a box-for-box swap of steel shot for lead shot.

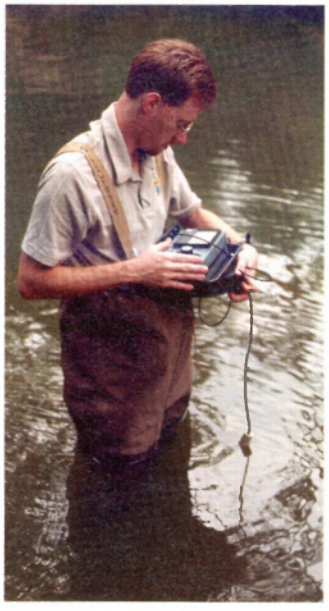
Only after all of these efforts were made was law enforcement brought onto the scene. Beginning March 1, 1998, the possession of lead shot by waterfowl hunters was no longer tolerated, and its discovery by agents resulted in a fine. To date, the rate of compliance with the lead shot ban has been impressive.

The relative importance of lead in the decline of the Y-K Delta spectacled eider population continues to be studied. Clearly, lead is a problem for this species. Although there is little we can do about the lead that is out there, there is a lot we can do to keep more lead from entering the environment. For now, eider management will continue to be predominately an exercise in reducing human impacts on eiders.

Greg Balogh is a Wildlife Biologist with the FWS Anchorage Ecological Services Field Office.

Fishing for Answers

by Tom Augspurger,
Jim Dwyer,
and John Fridell



Fish and Wildlife Service biologists will compare results of the lab tests to the water quality in the Cape Fear shiner habitats as part of a threat analysis for the listed fish.
Photo by Greg Cope/NC State University

How much pollution is too much for endangered species? Chemicals inevitably enter the environment because of their wide use by all of us. As in every State, the discharge of treated wastewater into North Carolina's waters from "point sources," such as municipalities and industries, is regulated by permit. These permitted levels are designed to maintain water quality at a level in compliance with the State's water quality standards. Pollution from "non-point sources," such as agricultural and residential activities, also finds its way into our waters.

Our current water quality standards were developed from information on the pollution sensitivities of many common freshwater organisms, such as the rainbow trout *(Oncorhynchus mykiss)*, fathead minnow *(Pimephales promelas)*, and a small crustacean, the cladoceran *(Ceriodaphnia dubia)*. However, the extent to which these standards protect threatened and endangered fishes and mussels is not known. Because listed species may be more sensitive to certain contaminants, the existing water quality standards may not be sufficient for their protection. Because it is also possible that some listed species are protected by existing water quality standards, biologists need additional information to ensure that recovery efforts are directed to address the most significant threats. The Fish and Wildlife Service's (FWS) Environmental Contaminants Program has forged a number of partnerships to address this data need and improve water quality for North Carolina's threatened and endangered aquatic species. The most exciting aspect of the North Carolina experience has been the spin-off benefits in the form of public outreach and a better understanding of these rare species.

In partnership with the Columbia (Missouri) Environmental Research Center, a facility of the U.S. Geological Survey's Biological Resources Division, toxicity tests are being conducted on three species of federally-listed fishes in North Carolina: the endangered Cape Fear shiner *(Notropis mekistocholas)*, the endangered shortnose sturgeon *(Acipenser brevirostrum)*, and the threatened spotfin chub *(Hybopsis monacha)*. The tests, or bioassays, assess species growth and survival under varying pollutant conditions. To conserve native populations, captively raised individuals were used. Preliminary results indicate that two of the listed species were somewhat more sensitive to some contaminants than commonly used test organisms, with the sturgeon being among the most sensitive fish species tested to date. When final results are in, they will be used by the FWS, along with the North Carolina Division of Water Quality and U.S. Environmental Protection Agency (EPA), to improve water quality standards where needed. In addition, toxicity information will help in developing recovery goals for these species.

Captive rearing has yielded an additional benefit to these fish species. Recovery efforts for the Cape Fear shiner, which was listed in 1987, got a boost with the first successful captive propagation of this fish in 1997. Under contract with the FWS, a private company, Conservation Fisheries, Inc., produced several thousand fry from 30 adult Cape Fear shiners collected in North Carolina's Rocky and Deep rivers. With support from the FWS Albemarle-Pamlico Coastal Ecosystems Program, Conservation Fisheries collected brood stock and transported them to their facility in Knoxville, Tennessee, with 100 percent survival. The North Carolina

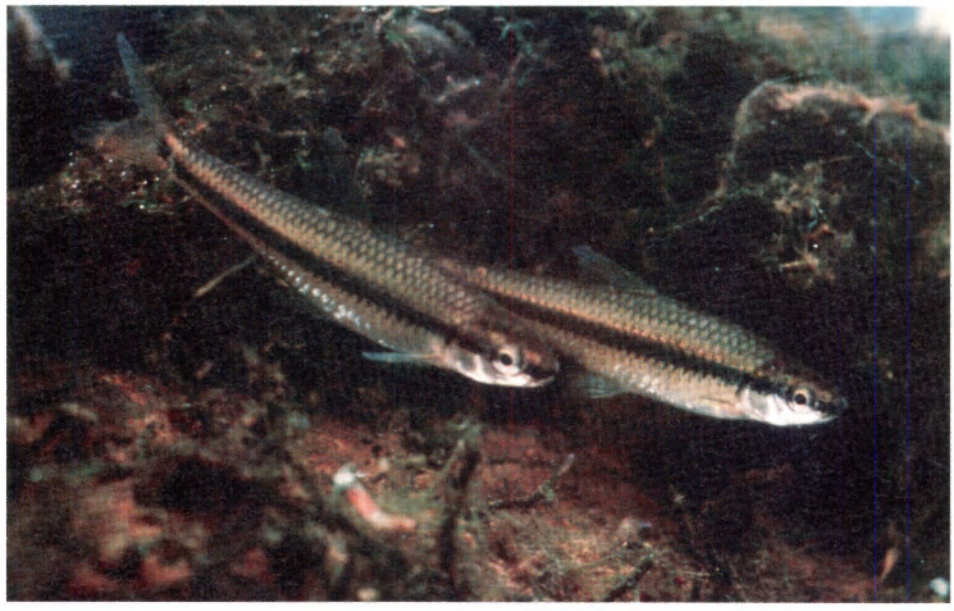
Wildlife Resources Commission's Nongame and Endangered Wildlife Program and the FWS Raleigh and Asheville, North Carolina, field offices—key partners in the project—assisted with collection of the brood stock. The adults reproduced in holding tanks within which yarn mops, which are used to mimic the structure of aquatic vegetation in the species' natural habitat, were placed.

The FWS Roanoke-Tar-Neuse-Cape Fear Ecosystem team joined the effort when 1,200 Cape Fear shiner offspring from the propagation effort were transferred to Edenton National Fish Hatchery in Edenton, North Carolina. The fish are being reared in three ways, with the effects of each treatment being evaluated relative to fish growth and survival. This information will be valuable in future propagation efforts. The hatchery's experienced staff volunteered expertise, time, and space in their facility to foster the project.

Progress is not just limited to research findings. The North Carolina Zoological Park received an FWS grant for a project that combines Cape Fear shiner life history research with much needed environmental education. The zoo has begun scientific documentation of the species' reproductive and feeding behaviors, and later this year the zoo will include the shiner in its "Streamside" exhibit. That exhibit, viewed by about 800,000 visitors each year, will be used to discuss the endangered status of the species, the importance of conserving it, and the need to protect water quality in the Cape Fear River basin. This protection will be vital to the long-term health of the Cape Fear shiner and people living within the watershed.

Since water quality is related to the overall health of aquatic species, we also enlisted the help of North Carolina State University's College of Veterinary Medicine to conduct a health assessment of the Cape Fear shiner. Our Warm Springs Fish Technical Center assisted with the field and lab components of this project last year. Upon completion, this will be the first report of diseases detected in this fish.

North Carolina also has a diverse molluscan fauna that includes five species on the Endangered Species List.



The endangered Cape Fear shiner was listed in part due to water quality concerns. Environmental Contaminants staff are assisting recovery efforts.
Photo By Dick Biggins/USFWS

Because these organisms also depend on good water quality for their survival and recovery, toxicologists have begun to include them in their evaluation of water quality standards. We have developed partnerships with the EPA's Science and Ecosystem Support Division and the University of Georgia's Department of Environmental Health Science, both located in Athens, Georgia, to conduct bioassays.

These projects are good examples of the integration of our Environmental Contaminant Program into recovery efforts. They compliment habitat assessments, threat analyses, and habitat conservation already in place through traditional Ecological Services programs, and the most direct beneficiaries will be North Carolina's endangered aquatic fauna. The lessons learned in these efforts, however, will likely have benefits nationwide.

Tom Augspurger, Jim Dwyer, and John Fridell are Biologists in the FWS Raleigh, North Carolina, Columbia, Missouri, and Asheville, North Carolina, field offices, respectively.

As Rachel Carson pointed out in *Silent Spring*, "...one of the most alarming aspects of the chemical pollution of water is the fact that here...are mingled chemicals that no responsible chemist would think of combining in his laboratory..." because "...interactions between these freely mixed chemicals...could easily occur, changing the nature of the chemicals in a way that is not only unpredictable but beyond control."

Fatal Attraction: Oil Field Waste Pits

by Pedro Ramirez, Jr.

Photo by Matthew Perry/USFWS

Two million migratory birds are estimated to die each year in oil and mining wastewater ponds in the western United States, according to Gary Mowad, a U.S. Fish and Wildlife Service (FWS) Special Agent in Lakewood, Colorado. Wildlife mortality in oil field waste pits has been documented by FWS special agents and environmental contaminants specialists. While documented losses of species protected under the Endangered Species Act are low, the risk is present, especially for protected birds and bats.

Bats have been found entrapped in oil-covered waste pits in several parts of the country. Several endangered species, including the gray bat *(Myotis grisescens)*, Indiana bat *(Myotis sodalis)*, lesser (Sanborn's) long-nosed bat *(Leptonycteris curasoae yerbabuenae)*, Mexican long-nosed bat *(Leptonycteris nivalis)*, and Ozark big-eared bat *(Corynorhinus townsendii ingens)*, occur in oil-producing states where the practice of using open pits or tanks is common. Although there are no documented cases of federally listed bats dying in oil pits, that is probably because these pits are not closely monitored and, even when a dead bat is found, its condition can make it difficult to identify the species. In the Southwest, individuals of two threatened bird species, bald eagles *(Haliaeetus leucocephalus)* and peregrine falcons *(Falco peregrinus)*, also have been found in oil field waste pits.

Pits and open tanks are commonly used to separate any water that is extracted from the oil-bearing formation along with the oil. Ineffective separation of oil and water results in wastewater covered by a layer of oil, creating a death trap for migratory birds and other wildlife. The wastewater is disposed of by deep-well injection, discharge into surface waters, or transfer to a commercial disposal facility. If the extracted water is discharged into surface waters, it must meet State water quality criteria. In Colorado, Wyoming, and New Mexico, some operators that cannot discharge into surface waters and cannot afford deep-well injection opt to transport the wastewater to commercial oil field-produced water disposal facilities. These facilities store the wastewater in large evaporation ponds that are an even greater attractive nuisance for birds and other wildlife. Oil pits are also used to contain oil spills or to catch oil drips.

The fatal attraction to waste pits often begins when insects become trapped in the oil and struggle to escape. As they struggle, their movements attract predators such as bats, songbirds, and small mammals. These animals in turn become trapped and their struggling attracts other predators, such as hawks and owls, which soon find themselves in the same deadly predicament. According to Bat Conservation International, bats are even more likely to become entrapped when they fly in for a drink. Bats drink on the wing and locate water sources by echolocation. A pond of oil-covered water would sound much the same to a bat as one with clear water.

Even if animals attracted to the oil-covered pits or ponds escape death by entrapment, they may ultimately die anyway. Birds or mammals may drink toxic quantities of oil, may become covered with oil and ingest toxic quantities as they try to clean them-

selves, or animals covered with oil may die from cold stress if the oil damages the insulation provided by their feathers or fur.

In addition to harming wildlife, oil pits can damage the environment or threaten human health. Oil from these pits can contaminate surrounding soil and seep into groundwater or nearby surface waters.

Historically, methods such as placing flags, reflectors, and strobe lights around oil pits were used to deter wildlife. However, published scientific studies, as well as field inspections by FWS biologists, have shown that these methods are not always successful. The use of propane cannons as "noisemakers" also has been attempted and, although they have proven successful in deterring birds under other circumstances, their use in oil pits has not solved the problem.

Solutions to the danger posed by oil pits include:

1. Use closed containment systems—These systems require little or no maintenance, can be moved from site to site, and eliminate the threats of soil contamination and wildlife entrapment.
2. Eliminate pits or keep oil from open pits or ponds—A fail-safe solution is to remove the pits, use a closed containment system, or keep oil from entering the pits.
3. Use effective and proven wildlife deterrents or exclusionary devices—Netting appears to be the most effective method of keeping birds and bats from entering waste pits.
4. Clean up any accidental spills immediately—Immediate cleanup is critical for preventing wildlife mortalities at any site.

In Region 6, a partnership among the FWS law enforcement and environmental contaminants programs, the U.S. Environmental Protection Agency (EPA), State regulatory agencies, and oil companies has reduced migratory bird and other wildlife losses in oil field waste pits. In most cases, it only took education, not legal action, to get companies to change their practices. In Colorado, Special Agent Mowad has seen the oil industry respond dramatically to the problem. "When we started our surveys in Colorado during the summer of 1995, 77 percent of the pits were either completely or partially covered with oil and posed a threat to migratory birds," he said. By the end of that year, the number was down to 10 percent. Mowad has also seen a comparable response in Wyoming. He credits the oil industry's cooperation for bringing oil field operations into compliance and says that peer pressure from within the industry has been enough to persuade most operators. "The work that we have done to get oil pits cleaned up in Region 6 has likely saved declining species" says Mowad. Likewise, the efforts by the oil industry to correct the problem in States with endangered bats will help these rare species as well.

Pits are used to separate oil from produced water at well sites such as this one in northastern Wyoming. Oil operators usually string colored flagging in an attempt to discourage birds from landing in these pits. Unfortunately, flagging has not prevented wildlife mortality.
Photo by Pedro Ramirez, Jr./USFWS

Pedro Ramirez, Jr., is an Environmental Contaminants Specialist in the FWS Cheyenne, Wyoming, Office.

Fish Creek Preservation and Restoration

by Dan Sparks, Cindy Chaffee, and Scott Sobiech

Like most midwestern streams, Fish Creek is threatened by pollution from certain land uses within its watershed. In its Fish Creek Bioreserve Project Strategic Plan, TNC identifies the primary threats as those that degrade water quality, water quantity, and habitat structure. Agriculture is the primary land use within Fish Creek's drainage. Wide-scale conversion of deciduous forests to intensive row crop production has led to increased erosion and water quality degradation from the runoff of soil particles and chemical pollutants (such as insecticides, herbicides, and fertilizers).

Mussels and the host fish upon which mussel glochidea (larvae) depend are especially vulnerable to such "non-point source" pollutants. Increased soil erosion results in stream bed siltation, which may directly smother some mussels or indirectly reduce population levels by degrading the habitat needed by their host fish. A loss of riparian vegetation decreases terrestrial and aquatic habitat structure, reduces shade (which may increase peak summer water temperatures), and increases stream bank erosion potential. A decline in native vegetation and wetlands also reduces groundwater recharge, which can further reduce

In September of 1993, a pipeline ruptured in a soybean field in DeKalb County, Indiana, and diesel fuel filtered through field tiles into a small drainage ditch and, finally, into Fish Creek.

Fish Creek is a tributary of the St. Joseph River in extreme northeastern Indiana and northwestern Ohio. It encompasses approximately 30 miles (48 kilometers) of primary stream channel and 90 miles (145 km) of tributaries and drainage ditches. The spill spread downstream into Williams County, Ohio, polluting the most sensitive sections of the creek.

Immediately after the spill, biologists observed dead fish, macroinvertebrates, mussels, turtles, frogs, snakes, muskrats *(Ondatra zibethicus)*, wood ducks *(Aix sponsa)*, and belted kingfishers *(Ceryle alcyon)*. Numerous dead mussels of three species were collected as a result of the oil spill. The ladyfinger (*Elliptio dilitata*) suffered the highest mortality, followed by the kidneyshell (*Ptychobrancus fasciolaris*). One individual of an endangered mussel, the clubshell (*Pleurobema clava*) also was found dead in the spill zone. This accident was a tremendous blow to a rich ecosystem that appears to be hovering on the threshold between sustainable, good water quality/ ecological integrity and a slide towards environmental degradation.

Fish Creek supports 45 species of fish and 31 species of mussels, including 3 endangered species: the white cat's paw pearly mussel *(Epioblasma obliquata perobliqua)*, northern riffleshell mussel *(Epioblasma torulosa rangiana)*, and clubshell mussel *(Pleurobema clava)*. The salamander mussel *(Simpsonaias ambigua)*, rayed bean *(Villosa fabalis)*, and purple lilliput *(Toxolasma lividus)*, considered species of concern, also are found in Fish Creek. The white cat's paw, according to the most recent scientific records, continues to survive nowhere else but in Fish Creek (Hoggarth 1990). In recognizing the values of Fish Creek, The Nature Conservancy (TNC) calls it "... the best remaining example of the unique riverine community that once characterized the western Lake Erie basin" (TNC, 1993; Unsworth and Snell, 1994).

Following the oil spill, the Fish and Wildlife Service, along with partner agencies, conducted a Natural Resource Damage Assessment, initiated with funding by the Oil Spill Liability Trust Fund, to determine the effects on fish and wildlife resources. A Memorandum of Agreement among the Department of the Interior, Indiana Department of Environmental Management, Indiana Department of Natural Resources, Ohio Environmental Protection Agency, and Ohio Department of Natural Resources, was developed to establish a unified approach to conducting the oil spill damage assessment.

Activities such as dredging/sediment removal or sediment agitation were considered but rejected as restoration options because they would have further injured the already imperiled mussel fauna. Faced with the possibility of implementing a lengthy and costly damage assessment, the natural re-

source trustees and the parties responsible for the oil spill agreed to focus on identifying restoration efforts that would most directly benefit the endangered mussel species (see sidebar). In January 1995, the Arco Pipe Line Company and Norco Pipeline, Inc., agreed to place $2,507,500 into a Court Registry Account to compensate for the serious environmental injuries caused by the oil spill and for the natural resource trustee council to prepare and implement a restoration plan.

Development of the Fish Creek Restoration Plan was completed in February 1997. It focused on five main objectives: enhancing mussel recovery, improving water quality, protecting (and in some cases enhancing or restoring) the riparian corridor, conducting public outreach plans, and monitoring restoration plan success. To date, restoration plan successes include the identification of seven fish species that serve as mussel hosts, reforestation of over 350 acres (140 hectares) of riparian zones and bottomlands, and acquisition of 103 acres (41 ha) containing almost a mile (1.6 km) of Fish Creek. Many more great things are anticipated for Fish Creek in the near future, including helping a local community expand its park to restore and protect a natural corridor along Fish Creek, assisting farmers with the purchase of no-till farming equipment to reduce erosion, and restoring wetlands on several privately held lands. The trustees are hopeful that efforts such as these will help to conserve the natural resources of Fish Creek for future generations.

Dan Sparks, Cindy Chaffee, and Scott Sobiech were all Fish and Wildlife Biologists in the FWS Bloomington, Indiana, Field Office when the spill occurred. Cindy currently works at the FWS Western Washington Office in Lacey, Washington. Scott works in the FWS Division of Environmental Contaminants in Arlington, Virginia.

References

Hoggarth, Michael. 1990. Recovery Plan for the White Cat s Paw Pearly Mussel. U.S. Fish and Wildlife Service.

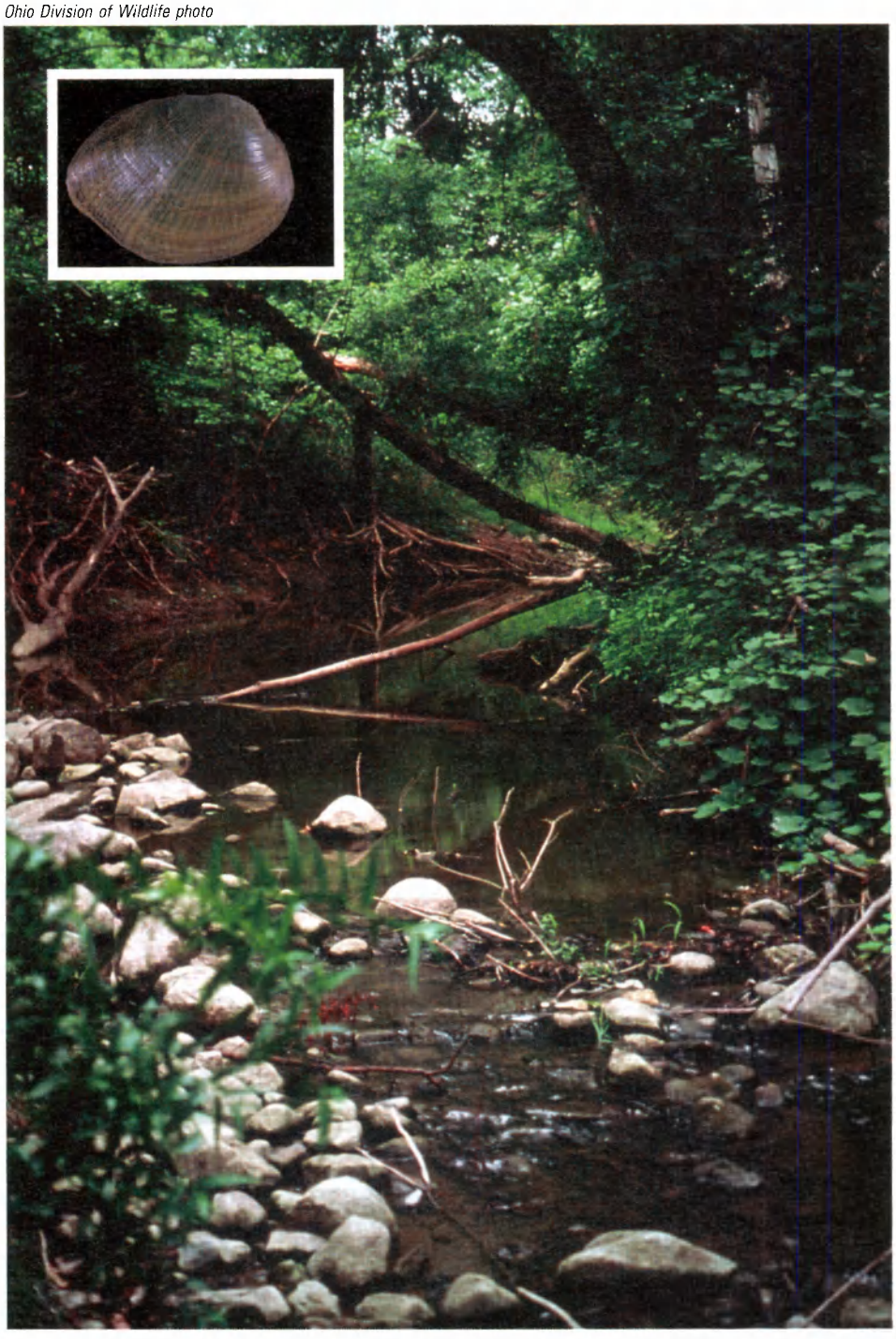
The Nature Conservancy. 1993. Fish Creek (Indiana, Ohio) Bioreserve Project: Strategic Plan - Draft. Indiana Field Office.

Unsworth, R.E., and E.W. Snell. 1994. Preliminary Economic Evaluation of Natural Resource Damages to Fish Creek, draft memorandum reporting on the preliminary economic evaluation.

stream flows during periods of little rain.

In Fish Creek, the entire historically reported mussel community and almost all of the original fish community remain in the system at some level, and recruitment is evident for most species.

(below) Fish creek
Photo by Dr. G. Thomas Watters
(inset) White cat's paw mussel
Ohio Division of Wildlife photo



CAFOs Feed a Growing Problem

by Kevin Stubbs
and Karen Cathey

USFWS photo

While eating their favorite hamburgers, chicken, or pork chops, people seldom stop to think about where these foods originate. If they do, a small family farm may come to mind. But that traditional picture is changing with the trend towards large, corporate agricultural operations.

The number of livestock animals concentrated in large concentrated animal feeding operations, or CAFOs, has increased dramatically in the last decade. During a 10-year period in California, the number of swine CAFOs decreased by 50 percent but the number of animals per operation rose 200 percent. Such CAFOs often house thousands of animals: in Texas, for example, nearly half of the permitted beef cattle CAFOs hold more than 16,000 animals. Because CAFOs are often clustered, local watersheds can be overloaded with nutrients, and possibly other contaminants, from discharges and run-off. Waste from animal feeding operations is degrading water quality and air quality in many areas of the country, from California to the Carolinas. The impacts from CAFOs may be both long-term and catastrophic.

Chronic, excessive discharge of nutrients over a long period of time leads to algal blooms, which lower dissolved oxygen levels in streams and lakes. These oxygen depleted waters are more suitable for species that are tolerant of poor water quality, less suitable for most sport fish or sensitive species, and usually result in lower species diversity.

Elevated levels of organic nutrients may favor proliferation of the microbe *Pfisteria*, which can kill fish and may even threaten human health. Excessive input of nutrients and anaerobic bottom sediments may also provide vectors for animal diseases such as *Salmonella*, *Staphylococcus*, *Streptococcus*, avian botulism *(Clostridium botulinum)*, and avian cholera *(Pasteurella multocida)*, microorganisms that can kill large numbers of waterfowl. Bacteria and other disease-causing organisms from CAFOs could also pose a health risk for people and wildlife, including direct or indirect adverse impacts on migratory bird populations. Ground water can also be polluted by excess nitrates and other contaminants that leach through the soil over time.

Accumulations of heavy metals and other contaminants may cause chronic problems affecting the health and reproduction of many aquatic and avian species, and contribute to water quality impairment and harm to aquatic organisms in local waterways. Some of the heavy metals in feed additives, such as zinc, copper, arsenic, nickel, manganese, and selenium, will end up in animal wastes and be concentrated in holding ponds and/or spread on fields as fertilizers. Concentrations of selenium (a trace mineral necessary in low levels but toxic in high levels) in surface waters of some CAFO waste storage pits or lagoons exceed safe levels for aquatic life by tenfold. Runoff or uncontrolled releases from CAFOs can transport selenium to natural water bodies, where it can increase in concentration as it makes its way up the food chain and may reach toxic levels in fish and other aquatic organisms. Excess heavy metals can be toxic to plants and lead to reproductive impairment, poor body condition, and immune system dysfunction in animals.

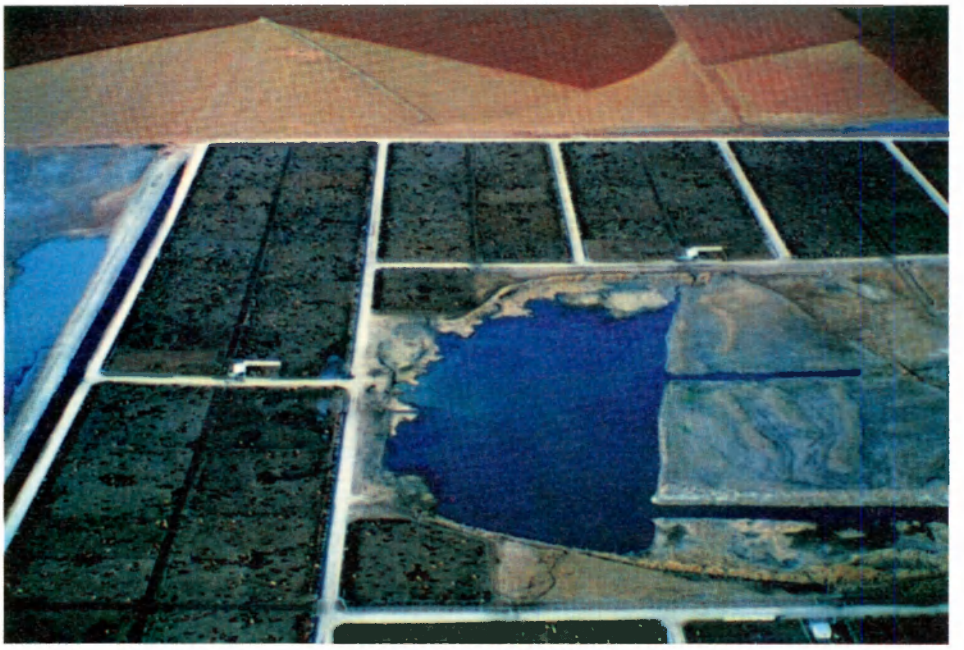
The catastrophic effects of sporadic large-scale CAFO discharges are more visible. Lagoon spills or overflows can discharge large volumes of animal waste into streams or lakes. When spills occur, high ammonia levels in animal waste lagoons can kill aquatic organisms and the large amounts of organic matter quickly deplete the oxygen in the water. Fish kills related to CAFOs occur each year, and the risks of large fish kills increases with the size and density of CAFOs in watersheds. For example, statistics from Nebraska indicate that one-half of the fish kills related to agricultural sources between 1989 and 1992 were caused by livestock waste. When a large swine lagoon in North Carolina breached, it killed fish and other aquatic organisms for 18 miles (30 kilometers) downstream.

The U.S. Fish and Wildlife Service (FWS) is becoming increasingly concerned about the potential effects of a growing CAFO industry on our nation's natural resources. A lack of coordination with the FWS in developing and implementing methods for CAFO management could lead to violations of Federal laws. For this reason, reviews of Environmental Protection Agency permits for CAFO construction, issued in compliance with the National Pollution Discharge Elimination System, are a growing part of our workload. Site selection for CAFOs should be based on a variety of factors relating to the vulnerability of natural resources, and buffer zones shielding sensitive surface waters should be designed into facilities at an early stage in the planning process. When properly used, animal waste is a good fertilizer and soil additive, but it must be carefully applied in a way that will minimize adverse effects to natural resources. Cooperation in developing long-term sustainable agricultural practices for CAFOs will preserve the productivity of our soils, protect the quality of our waters, and conserve our biodiversity.

Some potential impacts of CAFOs on the environment, such as the effects of excess nutrients, contaminants, and disease transmission, need additional research if we are to determine the full risks associated with long-term operation of animal feeding operations. These effects can have far reaching and long-term implications on the environment that both people and wildlife share. Contamination of soils and ground water are not easily or quickly corrected once they occur, and their effects on resources such as wetlands, fisheries, and federally-listed species may last for decades.

It is important that we gather the necessary information to protect the nation's fish and wildlife resources before watersheds are impaired to the point that additional species need to be listed or their recovery becomes too difficult and expensive. The research to determine potential effects of CAFOs on biological resources, prevent adverse effects, and restore contaminated watersheds is a priority of the FWS Environmental Contaminants Program.

Kevin Stubbs is a Biologist with the FWS Tulsa, Oklahoma, Field Office. Karen Cathey is the Natural Resource Damage Assessment Coordinator for the FWS Southwest Region in Albuquerque, New Mexico.



A large lagoon of liquid animal waste at a CAFO site.
USFWS photo

Some CAFOs are in locations that may result in take of species and habitats protected by the Endangered Species Act. In California, an 11 million gallon (42 million liter) spill of liquid waste from a large poultry farm damaged a wetland vernal pool system in the Arena Plains Unit of Merced National Wildlife Refuge, killing endangered vernal pool fairy shrimp *(Branchinecta lynchi)* and vernal pool tadpole shrimp *(Lepidurus pochardi)*. This resulted in a large fine, some of which went for acquisition of prime habitat for the refuge as compensation for damages to natural resources.

by John T. McCloskey

Aiding Wildlife on Military Lands

Bald eagle
USFWS photo

With development eliminating many of the large open spaces and contiguous forests in Virginia, the landscape is becoming increasingly fragmented. As a result, many of the military bases in Virginia have become safe havens for wildlife, including threatened and endangered species. Military installations in Virginia number approximately 30 and cover more than 200,000 acres (81,000 hectares).

One of the largest military installations in Virginia is the Marine Corps Combat Development Command at Quantico, located just south of Washington, D.C., on the Potomac River in Prince William and Stafford counties. The Quantico facility, which encompasses approximately 60,000 acres (24,000 ha), is larger than most of the county, state, or national parks in the area, and is a home for large populations of white-tailed deer *(Odocoileus virginianus)* and wild turkey *(Meleagris gallopavo)*. Quantico also provides habitat for such federally-listed threatened or endangered species such as the bald eagle *(Haliaeetus leucocephalus)*, dwarf wedge mussel *(Alasmidonta heterodon)*, and small whorled pogonia *(Isotria medeoloides)*, an orchid.

Most of Virginia's large military installations are located in the Chesapeake Bay watershed and provide many miles of undisturbed coastal marsh and shoreline habitat for threatened and endangered shorebirds. Tidal creeks on their lands also provide critical spawning habitat for anadromous fish, such as the striped bass *(Morone saxatilis)* and American shad *(Alosa sapidissima)*. Anadromous fish live in the ocean as adults, but swim into freshwater rivers and streams to reproduce. The relatively undisturbed marshes found on many military installations play a critical role in the continued survival of these species.

Military installations provide valuable upland habitat as well. For example, Fort Pickett, an Army installation encompassing approximately 45,000 acres (18,200 ha) in south-central Virginia, contains the largest known population of the endangered Michaux's sumac *(Rhus michauxii)*, a small deciduous shrub. The population is in a 10,000-acre (4,050-ha) artillery training area that is subject to frequent and intense fires. The success of this species at Fort Pickett seems to be related to the fire-maintained habitat at the base. Radford Army Ammunition Plant, located in western Virginia, hosts the regal fritillary butterfly *(Speyeria idalia)*. Once widespread, this Virginia population is one of only a few populations remaining in the eastern United States.

Land on military installations is not always pristine. Military training and testing activities on many facilities has contaminated lands with dangerous pollutants, which can cause adverse effects to wildlife and plant species

inhabiting these areas, including threatened and endangered species. Due to contamination, many of these military installations have become "Superfund" sites. The Superfund program, overseen by the Environmental Protection Agency (EPA), provides funding for clean-up of polluted sites. Biologists with the Fish and Wildlife Service's (FWS) Environmental Contaminants Program serve an important role by providing technical assistance to the EPA on the cleanup of Superfund and hazardous waste sites in ways that are compatible with the conservation of wildlife habitats. This work is carried out through the Biological Technical Assistance Group or BTAG. In addition to the FWS, other members of BTAG include biologists from the FPA and the U.S. Department of Commerce's National Oceanic and Atmospheric Administration. Through BTAG, our biologists currently provide technical assistance to the EPA on 20 military installations in Virginia, covering about 150,000 acres (60,700 ha).

In one example, our biologists provided recommendations that minimized adverse impacts to fish and wildlife, while improving habitat quality, on a 92-acre (37-ha) industrial waste landfill being cleaned up at the Naval Weapons Station in Yorktown, Virginia. Recommendations for improving habitat quality included the establishment of native grassland species on the landfill cap. This type of vegetative cover will not only control erosion on the soil cap but also provide valuable habitat for grassland birds and other declining wildlife species. Restoration projects at this site also included the construction of two small wetlands.

Our biologists also work through BTAG on the cleanup of excess property that is transferred by the military to the FWS. One recent transfer involved the former Woodbridge Army Research Facility, located approximately 7 miles (11 kilometers) south of Washington, D.C. in northern Virginia, which became Occoquan Bay National Wildlife Refuge (NWR). The property and nearby areas are used extensively by bald eagles. The Navy also transferred 285 acres (115 ha) of land occupied by the former Naval Radio Transmitting Facility, located in Suffolk, Virginia, to the FWS for expansion of the Nansemond NWR. Prior to property transfer, our biologists worked very closely with the EPA and the military to ensure that these properties were clean enough to serve as wildlife habitat. With successful rehabilitation, these former military installations can provide valuable coastal fish and wildlife habitat well into the future.

Striped bass
Photo by Don Pfitzer/USFWS

Our biologists provide a valuable and often overlooked role in the protection of threatened and endangered species on Superfund and other hazardous waste sites. Involvement in BTAG provides the opportunity to work with the military to ensure that restoration and habitat enhancement projects provide long-term benefits for wildlife. Without BTAG, the FWS would have fewer opportunities to protect and enhance habitat for wildlife, including threatened and endangered species, on polluted sites.

John T. McCloskey is an Environmental Contaminant Specialist in the FWS Virginia Field Office in Gloucester.

Restoring Habitat Through Pesticide Management

by Elaine Snyder-Conn, Mike Green, Sam Johnson, Tom O'Brien, Don Steffeck, and Scott Stenquist

A helicopter spraying pesticides
Photo by Brad E. Johns/USFWS

Six national wildlife refuges (NWR) in the Klamath Basin of northern California and southern Oregon are the remnants of what was once a vast wetland complex. Today, these refuges are vital to many species of wildlife. During spring and fall migrations, nearly 80 percent of all Pacific flyway waterfowl, totaling approximately 3 million birds, stop to rest and feed at these refuges. Overwintering bald eagles *(Haliaeetus leucocephalus)*, which are currently listed as threatened in the lower 48 States, use these refuges for roosting and foraging. Other listed species that rely on the refuges include the peregrine falcon *(Falco peregrinus)* and two fish species, the Lost River sucker *(Deltistes luxatus)* and shortnose sucker *(Chasmistes brevirostris)*.

Present day resource management in the Klamath Basin Complex reflects the public desire to conserve and protect valuable fish and wildlife habitat while, at the same time, sustaining agricultural activities that have a long history in the basin. For example, two of these refuges, Tule Lake and Lower Klamath NWRs, are managed under the Kuchel Act of 1964, which commits 22,000 acres (8,900 hectares) of the refuges to a commercial farm leasing program. Under a 1977 cooperative agreement with the Fish and Wildlife Service (FWS), agriculture management of these leased lands was transferred to the Bureau of Reclamation.

The Kuchel Act states that the Lower Klamath and Tule Lake NWRs are dedicated to "wildlife conservation for the major purpose of waterfowl management, but with full consideration to optimum agricultural use that is consistent therewith...." Agricultural activities on these refuges provide a means for achieving one of the major management objectives of these refuges which is to maintain enough crops to encourage waterfowl to stopover and forage during their fall migration instead of flying further south in the Central Valley of California, where they can decimate crops just before harvest.

Agricultural and pest management practices have not always considered the benefits and costs of pesticides to natural resources. In the 1940's, the refuges began using insecticides (especially DDT compounds, endrin, and toxaphene) and rodenticides (strychnine and zinc phosphide) to control pests, and by the 1950's, wildlife die-offs were observed. By the early 1990's, even after DDT was banned, the fish and wildlife death tolls were increasing and contaminant studies conducted by the FWS revealed that pesticides were the cause.

As the devastating effects of pesticide contamination were becoming more and more apparent, the FWS and Bureau of Reclamation began to implement the Department of Interior's new pesticide policy. This policy emphasized the implementation of Integrated Pest Management (IPM) practices. The IPM approach incorporates cultural, biological, and physical pest control methods, and considers pesticides only as a last resort.

While some IPM practices were being used by leased land farmers, such efforts were not coordinated or widespread. In June 1993, Reclamation and the FWS agreed to prepare a comprehensive IPM plan for the leased land. As part of this comprehensive review, consultations are being completed

under section 7 of the Endangered Species Act on the potential impacts of each pesticide on endangered or threatened species. The IPM's centerpiece is required systematic, weekly crop inspections by each farmer. By detecting the presence of pests early, preventive methods less harmful to the environment can be attempted before infestation occurs and pesticides are needed. These alternative methods include mechanical or moisture management and biological controls.

The uncurtailed use of pesticides began to change in the Klamath refuges as the FWS and Reclamation involved lease land operators in the preparation of pesticide use proposals (PUPS). PUPs are subject to review by biologists from both agencies who have knowledge of farming and the effects of pesticides on fish and wildlife. All PUPs incorporate IPM techniques and eliminate or restrict risks from use of the most toxic chemicals. In many cases, toxic pesticides (including all those documented to have killed wildlife) have been eliminated on the leased lands. For those pesticides that are most toxic to aquatic species, buffers and other restrictions are required for aerial and ground spraying to limit the potential for aerial drift.

Pesticide application methods have also changed. For example, some pesticides previously applied by aerial spraying are now applied near sensitive habitats only by precision ground injection or other ground application methods. Also, an array of pesticides with low toxicity to wildlife have been approved, providing alternatives to more toxic chemicals. In addition, a series of pesticide monitoring studies have been initiated to evaluate pesticide concentrations in Tule Lake and refuge drainwaters, evaluate the effectiveness of buffers, and search for dead animals.

Since 1994, no pesticides have been found at concentrations known to cause toxicity to fish or wildlife, nor have any pesticide-related wildlife deaths been documented in the refuges. The future of pesticide reductions rests not only on the IPM plan but also on sump rotation, whereby leased lands will be converted to new wetlands and the existing Tule Lake sumps will be rotated into croplands. Periodic flooding reduces the need for pesticides, increases use by a variety of birds, and benefits the endangered suckers.

The success of restoration efforts throughout the Klamath Basin is the result of people working together for natural resources. Karl Wirkus, Klamath Basin Area Office Manager for the Bureau of Reclamation; Tom Stewart, Klamath Basin Refuge Manager; and Klamath Fish and Wildlife Office Project Leader Steve Lewis agree that the collaborative effort of Reclamation, the FWS, and farmers is the key to success.

Elaine Snyder-Conn, USFWS-Klamath Fish and Wildlife Office; Mike Green, Bureau of Reclamation-Klamath Basin Area Office; Sam Johnson, USFWS-Klamath NWR Complex; Tom O'Brien and Don Steffeck, USFWS-Ecological Services-Environmental Contaminants-Portland Regional Office; and Scott Stenquist, USFWS-Refuges/Wildlife-Portland, Regional Office contributed to this article.

In addition to better pesticide management, other wildlife habitat improvement activities are taking place as well, such as the conversion of additional agricultural lands into wetlands (600 acres, or 240 hectares) and the restoration of deepwater habitats and migration corridors. These activities have encouraged reestablishment of a diverse wetland plant species community, replacing monospecific stands of bulrush now dominating Tule Lake. Reestablishment of Columbia yellow cress *(Rorippa columbiae)*, a species of concern last seen in the Tule lake area in 1928, also has been observed. To date, there has been a significant rise in the number of waterfowl visiting the refuges, and breeding waterbirds also have increased.

Lower Klamath NWR
Photo by John and Karen Hollingsworth

Habitat Restoration, Appalachian Style

by Robert S. Butler, Richard G. Biggins, and Nora A. Murdock

Fencing can prevent livestock damage to stream banks, reducing erosion and stream turbidity.
Photo by R.S. Butler/USFWS

A high level of biodiversity, particularly one encompassing the rarer components of riverine and mountain bog ecosystems, is the chief criterion in selecting areas for restoration efforts. The primary goals of Asheville's habitat restoration program are the reduction of non-point source pollution and the elimination of other threats to aquatic and bog communities. Habitat enhancement efforts will ultimately benefit nearly 50 federally-listed species (including 32 mussels, 10 fishes, and several plants) as well as dozens of other rare riverine and bog organisms.

A herd of Herefords mosey along after a lazy summer morning grazing the floodplain pasture. The cattle follow the familiar path leading to the thirst-quenching river they have relied on since birth. Suddenly, the lead animal gets a jolt, causing the rest of them to stop in their tracks. This herd has not yet adapted to the farmer's newly-installed electric fence that protects severely eroding stream banks from their hooves, nor to the alternate watering source, both provided through the Fish and Wildlife Service's (FWS) Partners for Fish and Wildlife program. But the cows will learn.

The Partners program was established to provide private landowners with funds to restore fish and wildlife habitats. At the same time, Partners projects such as stream bank restoration reduce significant non-point sources of water quality degradation. In fact, Partners funding has played an instrumental role in jump-starting the aquatic habitat restoration program of the FWS Asheville, North Carolina, Field Office. Working in an area that encompasses Kentucky, Tennessee, North Carolina, South Carolina, northern Alabama, and northern Georgia, the Asheville office currently coordinates 10 watershed-based riparian and 7 mountain bog habitat restoration projects. These restoration projects, now in various stages of implementation, are cooperative efforts among dozens of stakeholders, including several other FWS field offices and teams from three FWS ecosystems (Southern Appalachian, Lower Tennessee-Cumberland, and Ohio River Valley).

Asheville's habitat restoration initiatives have used Partners funds as seed money to help conservation organizations initiate specific projects. At the top of our long list of partners is The Nature Conservancy (TNC). With similar biodiversity protection goals, Asheville and TNC have formed a long-standing partnership in riparian habitat and mountain bog restoration projects.

The Clinch River Community Project (CRCP), initiated in 1993, is a classic example of building upon the expertise of several agencies and organizations to bring a major habitat restoration project to fruition. According to TNC, the upper Clinch River, located in the species-rich Tennessee River system, has more at-risk mussel and fish species (48) than any other small watershed in the country. A section of the Clinch in Hancock County, northeastern Tennessee, was chosen for concerted restoration activities by the Tennessee Chapter of TNC and our Asheville office. This stretch harbors 14 endangered or threatened species, 12 mussels and 2 fishes. TNC has leveraged $35,000 in FWS Partners funds in 1994 into over $650,000 for restoration efforts in this area. With the assistance of the Clinch-Powell Resource Conservation and Development Council (RC&D), Tennessee Wildlife Resources Agency, Tennessee Department of Agriculture, Tennessee Department of Environment and Conservation, Environmental Protection Agency (EPA), U.S. Geological Survey, Tennessee Valley Authority, Natural Resources Conservation Service (NRCS), local governments and agencies, various local organizations and individuals, and private landowners, TNC has restored habitat at over 20 sites in the watershed.

Restoration activities on the Clinch project include fencing of riparian

zones, providing alternate livestock watering sources, stabilizing heavy livestock use areas and stream crossings, installing erosion control structures, revegetating critical areas, improving riparian buffers and pond habitats, and improving pasture management. Being a community-based conservation project, other activities have included cleaning up illegal dump sites, providing low-cost rental farm equipment to community farmers, and hosting informational meetings for local landowners. The various activities of CRCP prove that farming activities and natural resource conservation are mutually compatible and economically feasible.

Based on the success of the CRCP, the FWS and other partners have provided funds enabling TNC to begin a restoration project on the Conasauga River. Located on the Georgia-Tennessee border in the highly imperiled Mobile Basin, the Conasauga River is another stream with high biodiversity. There are records of 12 federally-listed mussels and fishes and other rare aquatic species from the Conasauga. Although several of the rare mussels have disappeared from the river (some are extinct throughout their range), at least four listed mussels and three listed fishes still call the Conasauga home (see "The Conasauga Saga" in *Bulletin*, Vol. XXI, No. 6).

Another major project, launched with $49,000 in Partners funding, is located on the Little Tennessee River in western North Carolina. Administered by the Southwestern North Carolina RC&D through the grassroots Little Tennessee Watershed Association, this project has secured three separate $100,000 EPA Clean Water Act (section 319) grants for restoration projects in the Little Tennessee and an adjacent watershed, the Hiwassee River. Recently, this project received a grant from the North Carolina Clean Water Management Trust Fund, which earmarked $750,000 out of the $3.9 million grant specifically for riparian habitat restoration work in the Little Tennessee watershed. To date, about 20 landowners have participated in the project. Critical partners on this project include NRCS, EPA, Macon Soil and Water Conservation District, North Carolina Wildlife Resources Commission (NCWRC), U.S. Forest Service, Nantahala Power and Light, Nikwasi Land Trust, and private landowners.

To date, our Asheville office has leveraged $160,000 of Partners and $80,000 of endangered species recovery funding into over $2.2 million for aquatic habitat restoration activities using other Federal funds, along with State and private funding matches secured by our partners. The most crucial component of our activities, however, is active participation by willing landowners and local volunteers. Without them, restoration efforts would have little chance of success. With their support, we are entering an exciting age of ecosystem-based management for the improvement of water and habitat quality that benefits all species, including ourselves.

Robert S. Butler, Riparian Lands Restoration Biologist, Richard G. Biggins, Fish and Mollusk Recovery Coordinator, and Nora A. Murdock, Listing and Recovery Biologist, work in the FWS Asheville Office.

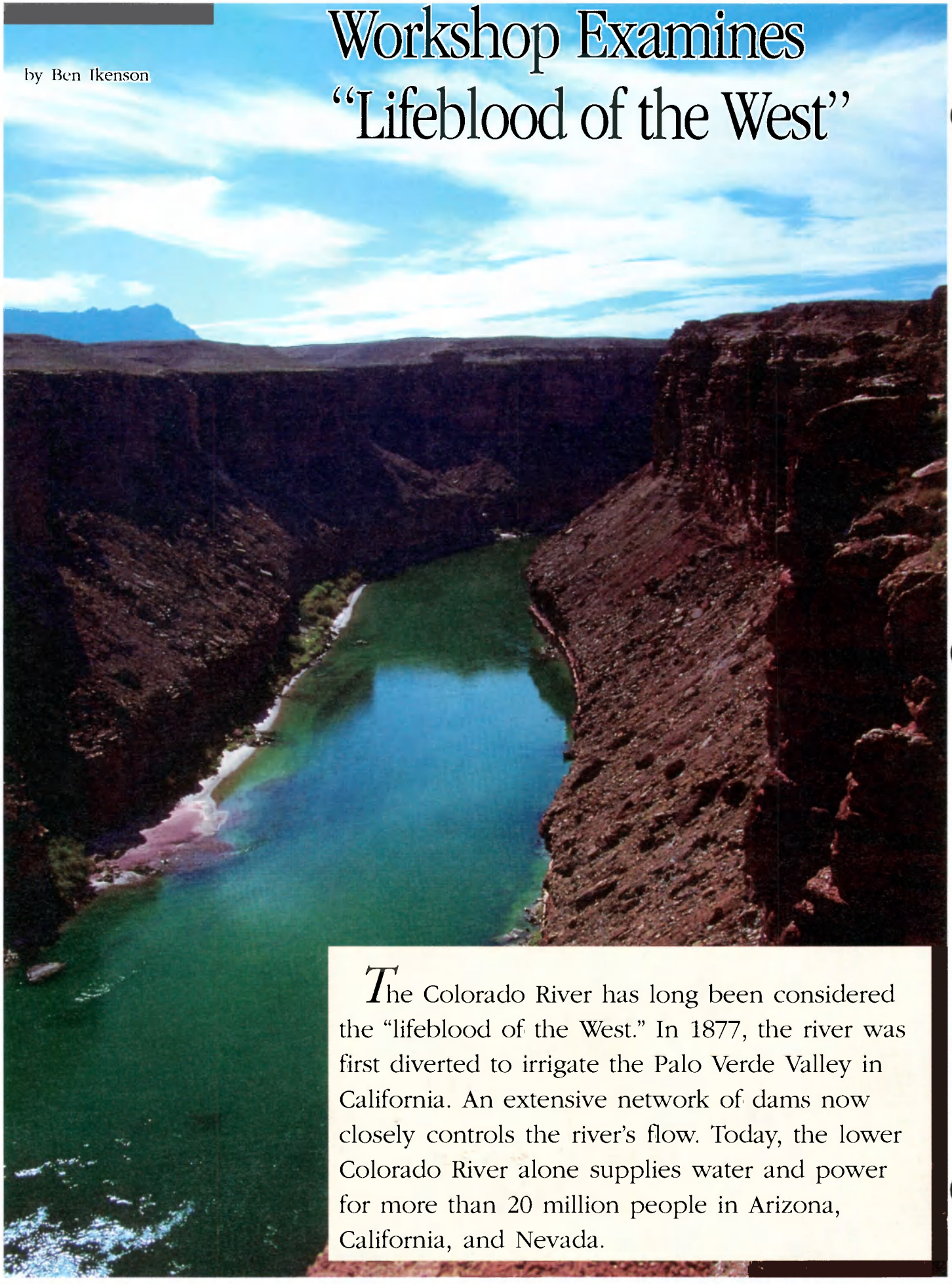
Photo by Nora Murdock/USFWS

Endangered pitcher plants depend on bog habitat.
USFWS photo

Our Asheville office also has initiated bog restoration projects in the Appalachian Mountains of western North Carolina and eastern Tennessee. One of the most endangered ecosystems in the southeast, mountain bogs harbor unique plant and animal communities, including five federally listed plants and animals, and one species currently proposed for listing. Stakeholders, which include TNC, Atlanta Botanical Garden, Zoo Atlanta, North Carolina Herpetological Society, North Carolina State Museum of Natural History, NCWRC, University of North Carolina at Asheville, University of North Carolina at Greensboro, NRCS, and bog owners, have banded together to protect and rehabilitate bog habitats. Specific restoration activities include restoring hydrology by plugging drain tiles once installed to convert bogs to agricultural lands, controlling nuisance invasive woody vegetation by practicing limited controlled burning (see photo at left) and other methods, and erecting riparian fencing. Rare plants and animals that had disappeared are being reintroduced into historically occupied bog sites where suitable habitat conditions have been restored.

Workshop Examines "Lifeblood of the West"

by Ben Ikenson



The Colorado River has long been considered the "lifeblood of the West." In 1877, the river was first diverted to irrigate the Palo Verde Valley in California. An extensive network of dams now closely controls the river's flow. Today, the lower Colorado River alone supplies water and power for more than 20 million people in Arizona, California, and Nevada.

In response to concerns following the U.S. Fish and Wildlife Service's (FWS) 1994 designation of critical habitat for four endangered fish species in the Colorado River Basin, the Lower Colorado River Multi-Species Conservation Program (MSCP) was formed. Representatives of Arizona, California, and Nevada, along with various water and power agencies and Native American Tribes, joined the regional partnership, which is aimed at protecting sensitive, threatened, and endangered species and their associated habitats. Last July, in Las Vegas, Nevada, a historic conference was held to discuss methods, concepts, and opportunities for restoring natural functions within the severely modified river.

In her opening remarks, FWS Southwest Regional Director Nancy Kaufman discussed how "over subscribed" the river is, painting a grim picture of potential water wars in the West, in which counties, cities, and states would vie for the purchase of costly water rights. "Think about a community of homeowners, each with a mortgage of a quarter of a million dollars, discovering that an overly optimistic water budget leaves their investment worthless because they can't get tap water."

After Kaufman spoke, Robert Johnson, Director for the Lower Colorado Region of the U.S. Bureau of Reclamation, encouraged the audience to explore the flexibility remaining in the "Law of the River." Dr. John Pitlick, a fluvial geomorphologist, spoke about hydrological and geomorphological aspects of large river restoration. Pitlick made the point that fish hatcheries serve a great purpose when they grow endangered fish species for release, but he added that it will make no contribution to the species' conservation if the habitats into which the fish are released are too degraded. The quality of the river itself must be improved, he said, calling the Lower Colorado River a "sediment-starved system."

Dr. Mark Bain, an aquatic scientist at Cornell University, spoke next on the benefits for native fishes that would result from flow enhancements downstream of large dams. He also stressed the importance of near-shore and shallow habitats, which can be transformed into "dead zones" as a result of dam operations. Using the Deerfield River in New England as a model, Bain referred to research that was used to justify enhanced flows for the purpose of restoring a diverse riverine fish fauna. "Species richness doubled," he reported, "and the abundance of fish increased 500 percent in sensitive shoreline habitats, with restored species being largely those specializing on flowing water microhabitats."

Dr. Julie Stromberg, an Associate Professor in the Plant Biology Department at Arizona State University, discussed the significance of restoring riparian vegetation in the Southwest, where "altered conditions select for a different suite of plant species, which then alters the functions and values of the plant community." Stromberg suggested one possible solution that may replicate the effects of the thwarted flow processes in order to appease the needs of the native pioneer plant species that depend upon periodic flood flows for regeneration. "In wet years, moderately high flows can be released in such a way to stimulate seed germination without compromising the human water supply. Prior to these germination flows, it may be necessary to mechanically scour aggraded flood plains and thereby mimic the geomorphic effects of large, seedbed-preparation flows."

Plans call for the MSCP to be implemented over a 50-year period. Ultimately, the goal is to reconnect the remaining fragile, fragmented parts of the river's native ecology, to restore natural function to the "lifeblood of the West."

Ben Ikenson is a Student Conservation Associate with the FWS Southwest Regional Office.

Dr. Stuart Leon, Recovery Coordinator for the FWS Southwest Region, and Glen Gould, fishery biologist for the U.S. Bureau of Reclamation's Lower Colorado Region, spent months planning and coordinating the conference. About 150 people attended, including members of the Colorado River Indian Tribes, representatives of water management agencies, environmentalists, and agricultural interests. Land management consultants mingled with experts on the "Law of the River," a comprehensive list of legislative documents comprising river management statutes. Seated throughout the hall were members of the MSCP steering committee, as well as staff from Willow Beach National Fish Hatchery and several national wildlife refuges associated with the Lower Colorado River.

(opposite page) Early Spanish explorers gave the Colorado River its name for the rich reddish-brown color of its flows. The construction of dams has trapped sediments and converted warm, muddy flows on some stretches to cold, clear water with a greenish appearance.
Corel Corp. photo

Rachel Carson's Legacy

By Mary G. Henry

Our agency's contaminants legacy started back in 1936 with Rachel Carson. After earning her Master's degree in biology from Johns Hopkins University, she joined the U.S. Bureau of Fisheries (now the FWS). Carson first worked as a writer and eventually as editor-in-chief of the Wildlife Information Division.

Excerpt from *Silent Spring:*
"...synthetic pesticides have been so thoroughly distributed throughout the animate and inanimate world that they occur virtually everywhere. They have been recovered from most of the major river systems and even from streams of groundwater flowing unseen through the earth. Residues of these chemicals linger in soil to which they may have been applied a dozen years before. They have entered and lodged in the bodies of fish, birds, reptiles, and domestic and wild animals so universally that scientists carrying on animal experiments find it almost impossible to locate subjects free from such contamination. They have been found in fish in remote mountain lakes, in earthworms burrowing in soil, in the eggs of birds—and in man himself. For these chemicals are now stored in the bodies of the vast majority of human beings, regardless of age. They occur in the mother's milk, and probably in the tissues of the unborn child."

During her 17 years as a government biologist, she became familiar with studies on fish and wildlife and the environmental impacts of pesticides on animal populations. At the time, little of this type of information had filtered into the popular press. Her decision to educate the public about the potential dangers facing wildlife and humans from chemical pesticides may have been influenced by reports of bird die-offs sent to her by a friend. Rachel Carson spent 5 years researching and writing *Silent Spring*, which was published in 1962. The public debate that ensued was huge, with the pesticide industry on one side and Carson (along with like-minded environmentalists and scientists) on the other. Regrettably, some of the same issues concerning the environmental consequences of using pesticides, especially when they are misused or overused, remain unresolved.

As a nature lover and naturalist, Rachel Carson made a point of regularly observing changes in biota as she walked through the woods and along the beach. This dedication to developing insight about the organisms and their environments is an ethic that today is very much alive in FWS biologists. Today's environmental contaminants biologists take pride in carrying on the legacy of Rachel Carson.

The Environmental Contaminants Program investigates the presence, magnitude, and effects of toxins and evaluates and applies solutions to contaminant problems on Federal and non-Federal lands. It is a daunting task. The greatest challenge is to prevent creating additional problems for the next generation. As a society, we owe it to ourselves and to our children to leave a living legacy. And as we face the future, many of us ask: what would Rachel Carson say to her agency today?

Photo courtesy of Rachel Carson Foundation

We like to think she would say, "Good job. Your scientists are doing important conservation work, protecting natural resources from pollution. Keep the momentum going...but do more. Contaminants are just beginning to be understood, and they will be with us for a long, long time."

by Gerry Jackson

"Nothing is more priceless and more worthy of preservation than the rich array of animal life with which our country has been blessed."

With these words, on December 28, 1973, President Richard Nixon signed the Endangered Species Act (ESA), a law that has proven to be one of the strongest and most foresighted efforts ever made to protect the delicate web of life.

Backed by a groundswell of public support, Congress, in enacting the ESA, committed the Nation to reversing the alarming trend of extinctions that threatened the biological integrity of our country's natural resources. Fervor for the law was spurred by the knowledge that over 500 species of native plants and animals had become extinct since Colonial days. Furthermore, half of these extinctions had occurred during the previous 50 years, from 1922 to 1972. Projections were that, within 25 years, an additional 40 mammals and birds and 25 fish species would become extinct if the trend were not halted.

Congresswoman Leonore K. Sullivan, who at that time chaired the House Committee on Merchant Marine and Fisheries, summarized the need felt by many for an ecological safety net. "Man's presence on the Earth is relatively recent and his domination over the world's life-support systems has taken place within a few short generations. Our ability to destroy, or almost destroy, all intelligent life on the planet became apparent only in this generation. A certain humility, and a sense of urgency, seem indicated."

While earlier endangered species laws passed in 1966 and 1969 raised public awareness about the plight of rare animals, it was the 1973 act that provided the real tools to help wildlife and plants facing extinction.

Under this law, endangered species conservation has built an impressive track record. In 25 years, the ESA has proven remarkably effective at preventing extinctions and slowing the decline of imperiled species. Nearly half of all species listed for a decade or more are now either stable or improving in status. Only seven, or less than 1 percent, have been found to be extinct. Preventing the extinction of the remaining 99 percent of listed species is one of the ESA's greatest successes.

Furthermore, since 1973, 11 species have been removed from the list due to recovery. Another 18 species (all but 3 of which are native to the United States) have been reclassified from endangered to the less critical category of threatened, including the American peregrine falcon *(Falco peregrinus anatum)*, bald eagle *(Haliaeetus leucocephalus)*, and gray wolf *(Canis lupus)*. Last June, Secretary Babbitt announced that these three species, and nearly 20 others, are now being considered for delisting or downlisting due at least in part to recovery progress.

Certainly, the ESA's first 25 years have not been without controversy—at times, intense controversy. Although protection of most species has gone without much public attention, a few, such as the snail darter *(Percina tanasi)* and northern spotted owl *(Strix occidentalis caurina)*, have been lightning rods for contention.

But in examining the facts, we find that economic development can be compatible with the goals of the ESA. Of more than 145,000 Federal actions reviewed formally and informally between 1979 and 1992, only 69—*or less than one-tenth of one percent*—resulted in a jeopardy decision where there was no reasonable and prudent alternative for protecting the species. This is an average of 2 of 11,000 projects reviewed annually.

Despite some controversy, the incremental knowledge gained through a quarter century of experience with the ESA has enabled the Fish and Wildlife Service to review, validate, fine-tune, and implement creative reforms designed to improve the ESA's effectiveness, while easing regulatory burdens on landowners and businesses, and encouraging the development of partnerships to conserve species. As we look back over the last 25 years of endangered species protection, we can see that implementation of the ESA has evolved in a very positive way. The approaches of the early days of the ESA—single species management, confrontation, and rigidity—have given way to a multi- species/ecosystem focus, landscape approaches to management, increased regulatory flexibility, and a new sense of partnership.

As we approach the Year 2000, citizens all over the globe are taking the time to reflect on the significance of the new millennium to each of us as individuals and to society as a whole. In keeping with this spirit, the *Endangered Species Bulletin* will carry a special feature in 1999, "The ESA at 25," that will look back over the last quarter century of endangered species conservation to measure our progress, celebrate our accomplishments, and report on the work yet to be done.

Gerry Jackson is the FWS Assistant Director for Ecological Services in Washington, D.C.

During October and November 1998, the Fish and Wildlife Service (FWS) published the following proposed and final Endangered Species Act (ESA) listing actions in the *Federal Register*:

Listing Proposals

Short-tailed Albatross *(Phoebastria albatrus)* Although the short-tailed albatross has been listed by the FWS as endangered since 1970, an administrative error led to its listing only as a foreign species. At present, it breeds only on several Japanese islands, but this bird ranges throughout the northern Pacific Ocean and north into the Bering Sea during the non-breeding season. Although there currently are no known breeding populations in the United States, the short-tailed albatross has been sighted in Alaskan waters, at Midway in the Hawaiian Islands, and along the west coast of North America as far south as the Baja Peninsula, Mexico. Originally numbering in the millions, the worldwide population of the short-tailed albatross has declined to fewer than 1,000. On November 2, 1998, the FWS published a proposal to extend ESA protection to this species within U.S. territory.

Elepaio
Photo by Eric VanderWerf

'Elepaio *(Chasiempis sandwichensis ibidis)* Once one of the most common endemic forest birds on the Hawaiian island of O'ahu, the 'elepaio has been eliminated from over 90 percent of its range. The most recent population estimate for this subspecies indicates that only 200 to 500 birds remain. The 'elepaio's decline was caused by: habitat loss and degradation; predation by non-native mammals; introduced avian disease; competition from alien birds; and the spread of exotic plants, which dramatically altered the structure and diversity of native forests. Because of these continuing threats, the FWS proposed on October 6, 1998, to list the 'elepaio as endangered.

Two Aquatic Snails Two species of aquatic snails found only in Limestone County, Alabama, were proposed on October 28 for listing as endangered. The armored snail *(Pyrgulopsis (=Marstonia) pachyta)* and slender campelona *(Campeloma decampi)* are in a particularly precarious position, being restricted to a few isolated sites along two or three short stream reaches. Threats to the quality of their aquatic habitat include siltation, agricultural runoff, and other changes in water chemistry. The slender campelona already has been eliminated from at least three-quarters of its historical distribution.

Dismal Swamp Southeastern Shrew *(Sorex longirostris fisheri)* In 1986, the FWS listed the Dismal Swamp southeastern shrew as threatened, based on information that this small mammal was restricted in range and reduced in numbers by habitat loss. Since that time, however, the FWS has received new data indicating that this subspecies has a wider distribution in Virginia and North Carolina than originally known and is not in danger. Accordingly, on October 21, 1998, the FWS proposed to remove the Dismal Swamp southeastern shrew from the threatened species list.

Final Listing Rules

Five California Desert Plants Five plant taxa in the pea family (Fabaceae), all restricted to the Sonoran, Mojave, and Great Basin deserts of California, were given ESA protection on October 6, 1998. The three considered most vulnerable to extinction were listed as endangered:

- Lane Mountain milk-vetch (*Astragalus jaegerianus*),
- Coachella Valley milk-vetch (*Astragalus lentiginosus var. coachellae*), and
- triple-ridged milk-vetch (*Astragalus tricarinatus*).

Because the danger facing the other two plants is not as immediate, they were listed as threatened:

- Fish Slough milk-vetch (*Astragalus lentiginous var. piscinensis*) and
- Peirson's milk-vetch (*Astragalus magdalenae* var. *peirsonii*).

The remaining habitat of all five plants is threatened by mining, urbanization, off-road vehicle use, pipeline maintenance practices, and wetland alteration.

Four California Wetland Plants Four plant taxa native to vernal pools and certain other wetlands in southwestern California and northwestern Baja California, Mexico, received ESA protection on October 13, 1998. The two in greatest peril were listed as endangered:

- Munz's onion (*Allium munzii*), a perennial herb in the lily family (Liliaceae) and
- San Jacinto Valley crownscale (*Atriplex coronata* var. *notatior*), an annual in the goosefoot family (Chenopodiaceae).

The other two wetland plants were listed as threatened:

- thread-leaved brodiaea (*Brodiaea filifolia*), a perennial herb in the lily family, and
- spreading navarretia (*Navarretia fossalis*), an annual herb in the phlox family (*Polemoniaceae*).

All four plants face habitat loss, degradation, and fragmentation resulting from: urban and agricultural development, pipeline construction, alteration of wetland hydrology, off-road vehicle use, livestock grazing, weed abatement, and competition from non-native plants.

Four Southwestern California Plants Another suite of plants native to southwestern California and northwestern Baja California, Mexico, also received ESA protection on October 13. One plant was listed as endangered:

- willowy monardella (*Monardella linoides* ssp. *viminea*), a perennial herb in the mint family (Lamiaceae).

The three other plants were listed as threatened:

- San Diego thornmint (*Acanthomintha ilicifolia*), an annual herb in the mint family,
- Laguna Beach dudleya (*Dudleya stolonifera*), a succulent perennial in the stonecrop family (Crassulaceae), and
- Otay tarplant (*Hemizonia conjugens*), an annual in the sunflower family (Asteraceae).

These four plants occur in coastal sage scrub, chaparral, and other grassland habitats. They are threatened by habitat loss, competition from non-native plants, off-road vehicle use, mining, grazing, and trampling by hikers.

Three California Chaparral/Scrub Plants A separate listing package, also published on October 13, extended ESA protection to three plants that are native to scrub and chaparral plant communities and are, in some cases, endemic to specific types of clay soils. Two of the taxa were listed as endangered:

- *Nevin's barberry* (Berberis nevinii), *an ever-*

green shrub in the barberry family (Berberidaceae) and

- *Mexican flannelbush* (Fremontodendron mexicanum), *an evergreen shrub or small tree in the cacao family (Sterculiaceae).*

The third plant was listed as threatened:

- *Vail Lake ceanothus* (Ceanothus ophiochilus), *a shrub in the buckthorn family (Rhamnaceae).*

These three species are threatened by habitat loss, non-native plants, off-road vehicle use, and the disruption of natural fire cycles. The original listing proposal for these plants also recommended ESA protection for a fourth plant, but this species was found not to need listing protection (see WITHDRAWALS below).

Virginia Sneezeweed *(Helenium virginicum)* This perennial in the aster family is restricted to seasonally inundated sinkhole ponds and meadows within Augusta and Rockingham counties in Virginia's Shenandoah Valley. Residential development, incompatible agricultural practices, filling and ditching of wetlands, and other threats to the plant's habitat led the FWS to list the Virginia sneezeweed as threatened on November 3, 1998.

Six Aquatic Snails Six species of aquatic snails found only in localized portions of the Black Warrior, Cahaba, Alabama, and Coosa rivers or their tributaries in central Alabama received ESA protection on October 28. Three of these species were listed as endangered:

- cylindrical lioplax (*Lioplax cyclostomaformis*),
- flat pebblesnail (*Lepyrium showalteri*), and
- plicate rocksnail (*Leptoxis plicata*).

The other three snails were listed as threatened:

- painted rocksnail (*Leptoxis taeniata*),
- round rocksnail (*Leptoxis ampla*), and
- lacy elimia (*Elimia crenatella*).

All six of these aquatic snails depend on clean, free-flowing stream habitats for their survival. Impoundments and water pollution have eliminated the snails from 90 percent or more of their historic range. The surviving populations are threatened by sediments and excess nutrients that wash into the streams.

Arkansas River Shiner *(Notropis girardi)* The Arkansas River shiner is a small fish found in the Canadian River in New Mexico, Oklahoma, and Texas and the Cimarron River in Kansas and Oklahoma. Both rivers are within the Arkansas River drainage, which gave this species its common name. Modification or destruction of habitat due to water diversions, groundwater pumping, construction of impoundments, and water pollution, along with competition from a non-native fish, originally led the FWS to propose listing the Arkansas River shiner as endangered. Additional data gathered since publication of the listing proposal indicate that the danger to this fish, while serious, is not as immediate as originally thought; therefore, the November 28 final listing rule classified the shiner as threatened rather than endangered. An introduced, non-native population of Arkansas River shiners in the Pecos River, New Mexico, is not protected under this decision.

Withdrawals

Two California Plants On October 6, 1998, the FWS withdrew a 1992 proposal to list two plant taxa native to California deserts, the shining milk-vetch *(Astragalus lentiginosus* var *micans)* and Sodaville milk-vetch *(Astragalus lentiginosus* var. *sesquimetralis)*. Subsequent to publication of the listing proposal, important habitat for both species gained protection after being transferred to wilderness management at Death Valley National Park.

San Xavier Talussnail *(Sonorella eremita)* In 1994, the FWS proposed to list this land snail, which is known only from a single hillside in Pima County, Arizona, as an endangered species. Since that time, the FWS has entered into a conservation agreement with the landowner that should ensure the long-term protection of this site and the snail. With potential threats to the habitat removed, the FWS withdrew the listing proposal on October 6, 1998.

Dehesa Beargrass *(Nolina interrata)* The original proposal to list the "three California chaparral/scrub plants" (see FINAL RULES above) included a proposal to list a fourth species, the Dehesa beargrass, as threatened. However, after a review of additional data, FWS biologists found that ESA protection for this species is not warranted, and the proposal for the Dehesa beargrass was withdrawn on October 13.

The Internet is a great source of environmental contaminant-related information. Here are some Web sites to get you started:

U.S. Fish and Wildlife Service, Environmental Contaminants Program
http.//www.fws.gov/r9dec/ecprog.html,
or select the "Environmental Contaminants" block from our main page at http://www.fws.gov. From this site, you can find a program overview, information on contaminant identification and assessment, and our role in Natural Resources Damage Assessment on the cleanup program under the Comprehensive Environmental Response, Compensation, and Liability Act.

The National Irrigation Water Quality Program
http://www.usbr.gov/niwqp/irrgwat2.html
The National Irrigation Water Quality Program is an inter-bureau program managed by the Department of the Interior This site documents an on-going investigation of the contaminating effects of irrigation drainwater in the western United States.

Contaminant Information Management and Analysis System (CIMAS)
http://orion.cr.usgs.gov/cimas-old/CIMAS
This site contains textual and spatial contaminant-related data for U.S. Fish and Wildlife Service trust lands and species. The data is available for interfacing with DBMS and GIS software.

Biomonitoring of Environmental Status and Trends
http://www.best.usgs.gov/
The primary goals of the Biomonitoring of Environmental Status and Trends Program are to: (1) determine the status and trends of environmental contaminants and their effects on biological resources, (2) identify, assess and predict the effects of contaminants on ecosystems and biological populations, and (3) provide information in a timely manner.

Environmental Protection Agency, Office of Pesticide Programs, Endangered Species Protection Program
http://www.epa.gov/espp/
This page describes the program and its goals to protect endangered species from harmful pesticides and minimize impacts on pesticide users.

Prepared by Martha Balis-Larsen of the FWS Division of Endangered Species in Arlington, Va.

BOX SCORE

Listings and Recovery Plans as of February 28, 1999

GROUP	ENDANGERED U.S.	ENDANGERED FOREIGN	THREATENED U.S.	THREATENED FOREIGN	TOTAL LISTINGS	U.S. SPECIES W/ PLANS**
MAMMALS	60	251	8	16	335	49
BIRDS	75	178	15	6	274	77
REPTILES	14	65	21	14	114	30
AMPHIBIANS	9	8	7	1	25	11
FISHES	70	11	40	0	121	88
SNAILS	18	1	10	0	29	20
CLAMS	61	2	8	0	71	45
CRUSTACEANS	17	0	3	0	20	12
INSECTS	28	4	9	0	41	27
ARACHNIDS	5	0	0	0	5	5
ANIMAL SUBTOTAL	357	520	121	37	1,035	364
FLOWERING PLANTS	539	1	132	0	672	493
CONIFERS	2	0	1	2	5	2
FERNS AND OTHERS	26	0	2	0	28	26
PLANT SUBTOTAL	567	1	135	2	705	521
GRAND TOTAL	924	521	256	39	1,740*	885

TOTAL U.S. ENDANGERED: 924 (357 animals, 567 plants)
TOTAL U.S. THREATENED: 256 (121 animals, 135 plants)
TOTAL U.S. LISTED: 1180 (478 animals***, 702 plants)

*Separate populations of a species listed both as Endangered and Threatened are tallied once, for the endangered population only. Those species are the argali, chimpanzee, leopard, Stellar sea lion, gray wolf, piping plover, roseate tern, green sea turtle, saltwater crocodile, and olive ridley sea turtle. For the purposes of the Endangered Species Act, the term "species" can mean a species, subspecies, or distinct vertebrate population. Several entries also represent entire genera or even families.

**There are 517 approved recovery plans. Some recovery plans cover more than one species, and a few species have separate plans covering different parts of their ranges. Recovery plans are drawn up only for listed species that occur in the United States.

***Nine animal species have dual status in the U.S.

ENDANGERED Species BULLETIN

U.S. Department of the Interior
Fish and Wildlife Service
Washington, D.C. 20240